

What is claimed is:

1. A method of fuel vapor management for a fuel system of an internal combustion engine, comprising the steps of:
 - locating a pressure and temperature sensor upstream of a canister;
 - when the engine is not running, performing a leak detection diagnostic including the steps of detecting a fuel vapor pressure and temperature using the pressure sensor and the temperature sensor, respectively, and determining, based upon the detected pressure and temperature, whether there is a leak in the fuel system; and
 - when the engine is running, performing a purge valve diagnostic including the steps of measuring a temperature using the temperature sensor and based on the measured temperature, diagnosing the performance of the purge valve.
2. The method of claim 1, wherein the performing the purge valve diagnostic includes the step of inferring a presence or absence of fuel vapor flow within the fuel system based on the measured temperature.
3. The method of claim 1, wherein the performing the purge valve diagnostic further includes the step of measuring a plurality of temperatures and based upon the plurality of measured temperatures, inferring a presence or absence of fuel vapor flow within the fuel system.
4. The method of claim 1, wherein the detecting a fuel vapor pressure includes the step of detecting an actuation of the pressure sensor.
5. The method of claim 1, further including the step of providing a housing defining an interior chamber, and the interior chamber containing a valve separating the interior chamber into first and second portions, and disposing the temperature and pressure sensors in the interior chamber.

6. The method of claim 5, further including the step of locating a circuit board within one of the first and second portions, the circuit board including the pressure and temperature sensor.
7. The method of claim 5, wherein the detecting a fuel vapor pressure includes the step of actuating the pressure sensor by movement of the valve.
8. The method of claim 5, further including the steps of providing an external air intake as part of the second portion and a fuel vapor collection canister end as part of the first portion and locating the pressure and temperature sensors in the first portion.
9. The method of claim 1, wherein the purge valve diagnostic step includes measuring a plurality of temperatures over a predetermined time interval.
10. The method of claim 5, further including the steps of :
using a pressure operable device comprising the valve;
locating the pressure and temperature sensors in the first portion; and
providing the first portion in continuous fluid communication with the canister and the second portion in continuous fluid communication with a vent port.
11. The method of claim 10, wherein the providing step further includes :
providing a poppet movable along an axis and a seal adapted to cooperatively engage the poppet as the pressure operable device, wherein a first arrangement of the pressure operable device occurs when there is a first negative pressure level in the fuel vapor collection canister relative to the vent port and the seal is in a first deformed configuration, a second arrangement of the pressure operable device permits a first fluid flow from the vent port to the fuel vapor collection canister when the seal is in a second deformed configuration, and a third arrangement of the pressure operable device permits a second fluid flow from the fuel vapor collection canister to the vent port when the seal is in an un-deformed configuration, and the pressure sensor signals the first arrangement of the pressure operable device.

12. The method of claim 11, further including the step of orientating the poppet so that it is movable along an axis between a first position, a second position, and an intermediate position between the first and second positions.

13. The method of claim 12, wherein the first and second arrangements of the pressure operable device comprise the poppet in the second position, and the third arrangement of the pressure operable device comprises the poppet in the first position.

14. The method of claim 13, wherein a spring biases the poppet towards the second position.

15. The method of claim 1, wherein the locating step further includes locating a purge valve upstream of an intake manifold so that the purge valve controls the flow of fuel vapor from the canister to the intake manifold.

16. The method of claim 1, further including providing one and only one fluid passageway between the pressure and temperature sensor and the engine intake manifold.

17. A fuel vapor management apparatus for a fuel system of an internal combustion engine, comprising:

a housing located upstream of a canister, purge valve and engine intake manifold and downstream of an external air vent;

a first sensor located in the housing and configured to detect a change in pressure; and

a second sensor located in the housing and including a first temperature measuring configuration and a second temperature measuring configuration.

18. The apparatus of claim 17, further comprising:

the housing defining an interior chamber, the interior chamber containing a valve separating the interior chamber into first and second portions; and

the first and second sensors are in the interior chamber.

19. The apparatus of claim 18, wherein the valve includes a poppet.
20. The apparatus of claim 19, wherein the poppet is configured to be actuated by a change in pressure between the first and second portions.
21. The apparatus of claim 18, wherein the valve is a pressure operable device.
22. The apparatus of claim 18, wherein the valve includes a poppet configured to engage an elastic seal.
23. The apparatus of claim 17, wherein the first sensor and first temperature measuring configuration are operable during a leak detection diagnostic and the second temperature measuring configuration is operable during a purge valve diagnostic.
24. The apparatus of claim 17, wherein the first temperature measuring configuration has a switch in an open position and the second temperature measuring configuration has the switch configured in a closed position.
25. The apparatus of claim 17, wherein the second sensor includes a resistor.
26. The apparatus of claim 17, wherein the second sensor includes a thermistor.
27. The apparatus of claim 18, wherein the first sensor provides a signal based upon motion of the valve.
28. The apparatus of claim 17, further including a circuit board, the circuit board including the first and second sensor.
29. The apparatus of claim 28, wherein the circuit board is located within a housing that includes a vacuum relief valve.

30. The apparatus of claim 17, wherein the first temperature measuring configuration is adapted for measuring the approximate temperature of fuel vapor throughout the fuel system.

31. The apparatus of claim 17, wherein the second sensor includes a resistor and a resistor circuit and the resistor circuit is configured in an off position in the first measuring configuration whereby the resistor is disabled.

32. The apparatus of claim 17, wherein the second sensor is adapted for measuring a first temperature of fluid in its immediate vicinity when the headspace has a second temperature and the first temperature is substantially greater than the second temperature.

33. The apparatus of claim 17, wherein the second sensor includes a heating resistor and a resistor circuit configured in an on position in the second measuring configuration whereby the resistor is enabled.

34. The apparatus of claim 18, further including :
a pressure operable device comprising the valve;
the pressure and temperature sensors are disposed in the first portion; and
the first portion is in continuous fluid communication with a fuel vapor collection canister and the second portion is in continuous fluid communication with a vent port.

35. The apparatus of claim 34, wherein the pressure operable device further includes:
a poppet movable along an axis and a seal adapted to cooperatively engage the poppet, wherein a first arrangement of the pressure operable device occurs when there is a first negative pressure level in the fuel vapor collection canister relative to the vent port and the seal is in a first deformed configuration, a second arrangement of the pressure operable device permits a first fluid flow from the vent port to the fuel vapor collection canister when the seal is in a second deformed configuration, and a third arrangement of the pressure operable device permits a second fluid flow from the fuel vapor collection canister to the vent port

when the seal is in an un-deformed configuration, and wherein the pressure sensor signals the first arrangement of the pressure operable device.

36. The apparatus of claim 35, wherein the poppet is configured to move along an axis between a first position, a second position, and an intermediate position between the first and second positions.

37. The apparatus of claim 36, wherein the first and second arrangements of the pressure operable device comprise the poppet in the second position, and the third arrangement of the pressure operable device comprise the poppet in the first position.

38. The method of claim 37, wherein a spring biases the poppet towards the second position.

39. The apparatus of claim 17, wherein the first and second sensors reside on a common circuit board.

40. The apparatus of claim 17, wherein the first and second sensors are positioned adjacent to a valve.